



2016

# Kilwa

## Sustainable architecture



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*Kilwa Masoko street view*





**Hamidu Mtemekela**  
Town Planner and  
Township Executive Director

I am honored to present the rich architecture of Kilwa, one of the fascinating resources of our landscape. This book aims to identify, protect and promote our local construction techniques and materials to reduce construction costs, increase the income of the local population, and ensure that new settlements are developed in a sustainable way, without harming our environmental and cultural values. It oversees different examples of building structures, settlement patterns and landscape features that make this part of Tanzania unique.

The promotion of local architecture is very important to provide inspiration to our communities, to investors and builders and to all those who could impact on our urban and rural landscapes. This book encourages the continuous use of local materials and techniques rather than imported ones to protect our cultural values and support our local economy.

In urban areas most houses are constructed using a mixture of traditional and imported materials resulting in a fragmented landscape. This book establishes recommendations to protect our local architecture with the close participation of the community. But recommendations alone will not work; we need Master Urban Plans for urban areas and Land Use Plans for our villages. Nevertheless, this document can be used as a guide to control developments in urban and rural areas.

I would like to thank the European Union for their financial assistance, CRAterre for their technical support, as well as all local experts and Kilwa residents who have participated in the preparation of this book. I am grateful for all their moral and material initiatives which ensure that local culture is one of the lines that our agendas follow.





*House under construction, Lihimalyao village, Kilwa District*



"The heritage of a nation is essential to the ability of its citizens to preserve their identity and self-esteem, to profit from their diversity and their history, and build themselves a better future"

**Irina Bokova**  
UNESCO Director-General

This document aims to provide ideas and recommendations to anyone planning to build in Kilwa Masoko (private house owners, hotel owners, investors...). Furthermore, the document intends to provide useful inputs for future Urban and Landscape regulations for Kilwa Kisiwani Island, to ensure that the authenticity of the UNESCO World Heritage Site is preserved. This study is based on experience gathered during the construction of the Kilwa Information Centre in May-June 2015. It also integrates ideas extracted from the workshops held by Kilwa Masoko Township and Ocean Rochefort with local stakeholders in January 2015 and working sessions held with Kilwa urban planners.

The culture of Kilwa can provide very interesting lessons for sustainable development of the region, promoting its local economy while preserving its environment. Kilwa Masoko and the other small towns in the District are growing fast, but are evolving without Master Plans to control land use and regulate architecture. New building styles will emerge in the landscape, affecting their overall character of the region. But the level of authenticity and integrity remains very high in most towns and villages. It is not too late to regulate urban development to maintain this character and authenticity. We can still draw inspiration from various traditional practices to promote a sustainable way of living. This resource should be considered as a basis to develop urban development policy.

The recommendations presented at the end of the document are intended to serve the collective interests of Kilwa inhabitants. The will of a particular person should not interfere with the common interests of the whole community. A good house should make the life of its inhabitants easier, not only as an efficient shelter, but also as an asset which is easy to manage in the cultural, environmental and economic context. Understanding and respecting the values that shaped the local architecture is a way to keep the spirit of the ancestors alive.

As a consequence, the landscape will preserve its authenticity and impact positively on visitors' experience, and therefore on the local economy. In order to preserve the true Kilwa spirit, the next pages present some of the features that make Kilwa Masoko beautiful, unique and valuable.





# Kilwa urban features

3

## Barazas

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Barazas are covered spaces, which create a transition between public space and private interiors. The name is derived from the Arabic word for bench. Barazas are sitting places where family, friends and neighbours spend time resting and discussing.

## Swahili benches

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Swahili benches, also known as barazas are widespread in Masoko. Different shapes can be seen along the front elevation of houses. Generally built with stones and lime mortar, they have a specific shape with sloping back rests on each side, which allow a person to lay down comfortably and even sleep.

## Thatched roofs

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Thatched roofs of all sizes and shapes can be found in Masoko. They offer a cool interior that no other material can provide. Several thatching techniques exist as explained in chapter 6. Because of their steep slopes, they contribute significantly to the character of the place.

## Ventilation details

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Masoko carpenters have great experience in building thatched roofs and can design very complex shapes. One of the striking details in thatched roofs is the creativity in the ventilation details.





# Kilwa urban features

3

## Bandas

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Bandas are open sheds, generally surrounded with wooden or bamboo barriers. They serve all sorts of public or private uses and can have various sizes. Most bandas in Masoko are small commercial ventures and occupy less than 10 m<sup>2</sup> of land.

## Fences

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Private compounds are often enclosed with trees, flowers and fences made of organic materials such as palm leaves or bamboo. They create beautiful features in the landscape that blend well with the environment.

## Gardens

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Colourful shrubs and flowers are common along the streets, in front of houses or even growing on fences. They create beautiful scenery in town and attract large communities of butterflies.

## Street trees

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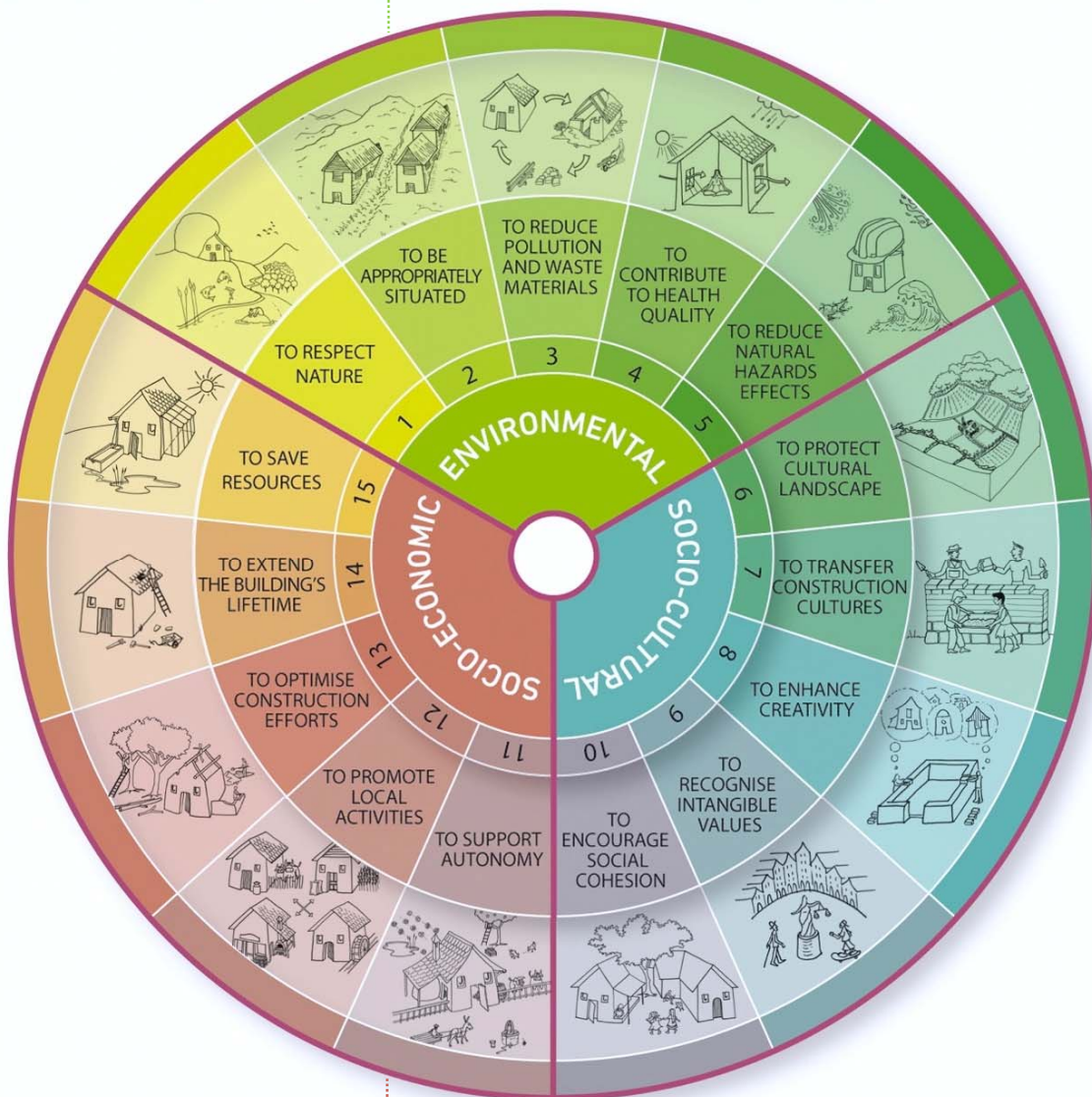
Kilwa is also blessed with a variety of trees, including baobabs, palm trees, neem trees or flamboyant trees, to name just a few. They provide shade in the compounds and along the streets, and attract a great number of birds into town.





### Local architecture values:

It is an evolved culture created by its people  
 It is the most intelligent form of architecture  
 It responds to the way of life of the culture that produces it  
 It is based on local materials and techniques  
 It expresses its environmental and historical context



# Sustainability principles 4

**15 sustainability principles embodied in local architecture are presented on the circle shown on the opposite page. They are classified under three groups:**



## **ENVIRONMENTAL PRINCIPLES**

*Architecture is a result of its natural environment and blends with it. Most buildings in Kilwa reflect the resources that are visible in the landscape. They are easy to find and do not pollute the environment when houses are demolished or abandoned.*



## **SOCIO-CULTURAL PRINCIPLES**

*Architecture helps to preserve and spread inherited values. Kilwa houses are very similar in size and shape. They result from a long experience, transferred from one generation to the next. Despite the resemblances, each house reflects the creativity of its builders and displays unique ornaments and construction details.*



## **SOCIO-ECONOMIC PRINCIPLES**

*Architecture empowers communities and optimizes local resources. Kilwa craftspeople have the skills and experience to build and maintain all sorts of buildings. They do not rely on other builders to produce their architecture. This local architecture is adapted to the needs of its users, their financial resources and to the skills of their craftspeople.*





# Sustainability principles

4

1

These bandas are made with the leaves of the palm trees that grow along the beach.

2

This picture shows small bandas in Kilwa Kivinje. The location and the materials used ensure the comfort of users.

3

Traditional thatched house in Makubuli harbour, in Kilwa Masoko. The impact of this house on the environment is minimal as compared to the brick and cement house visible in the background.

4

Wattle and daub house (Nyumba za udongo) under construction in Lihimalyao village. These materials are healthy for the users and ensure a healthy environment. The mud walls contribute to the regulation of humidity and heat in the house.

5

Wattle and daub school in Lihimalyao village. These building materials are flexible enough to resist strong winds. Thatched roofs are less prone to wind destruction than iron sheet roofs. If some of the thatched is removed by the wind, the risk of injury for the kids is less than if a metal sheet falls off the roof.

In order to understand the intelligence of Kilwa architecture in terms of sustainability, various examples are presented below showing how the village responds positively or negatively to 15 principles

## ENVIRONMENTAL PRINCIPLES

### 1. TO RESPECT NATURE

The habitat is integrated in the environment and does not harm other elements of it.

### 2. TO BE APPROPRIATELY SITUATED

The habitat takes advantage of the site's bioclimatic features.

### 3. TO REDUCE POLLUTION AND WASTE MATERIALS

The habitat optimises resources in order to avoid pollution and other impacts.

### 4. TO CONTRIBUTE TO HEALTH

The habitat offers the opportunity to inhabitants to live in a healthy environment.

### 5. TO REDUCE NATURAL HAZARDS

The habitat provides a safe and protecting environment for all its inhabitants.





# Sustainability principles

4

6

Lihimalyao village landscape, created by the beautiful alignment of simple houses, all fitted with barazas facing the street.

7

Family building a house in Lihimalyao village. Kids learn the skills on site. This is how the construction culture passes from one generation to the other.

8

House simply decorated with red clay and small white stones taken from the nearby landscape.

9

Sacred space protecting the compound against bad spirits. Intangible values are embodied in these sacred elements.

10

Double storey building made of local materials in Njinjo. This structure houses a tailor and a bar. Apart from the technical performance, this structure contributes to the social cohesion of the town.

## SOCIO-CULTURAL PRINCIPLES

### 6. TO PROTECT THE CULTURAL LANDSCAPE

The landscape is shaped and conserved by inhabitants through the centuries. Inhabitants respect the existing landscape values when building a new house.

### 7. TO TRANSFER CONSTRUCTION CULTURES

The architecture expresses traditional skills and knowledge. All the skills used in building are available in the community and evolve with the successive generations of craftspeople.

### 8. TO ENHANCE CREATIVITY

The architecture encourages innovative designs and creative solutions. Using the same resources for centuries is not necessarily a limitation to creativity, as shown on picture N°10.

### 9. TO RECOGNISE INTANGIBLE VALUES

The architecture values territorial identities as a result of an accumulated experience.

### 10. TO ENCOURAGE SOCIAL COHESION

The architecture facilitates exchanges among neighbours to feed a collective intelligence.





# Sustainability principles

4

11

Salt farm in Kilwa Masoko.

Salt is one of the resources contributing to the financial autonomy of the population.

12

Manufacturing of mats by women in Makubuli, Kilwa Masoko. The preparation of mats, ropes, roofing elements with leaves enhances local commercial activities.

13

Local construction techniques require very little inputs in terms of energy, tools or machinery. Most of the work is done with the hands alone, and tools are needed, they are locally produced tools manufactured by local blacksmiths.

14

Repairs on a thatched roof. Local construction technique allow for easy maintenance of buildings. This picture shows a craftsman replacing thatch shingles.

15

Many houses are sourcing energy from the sun. Solar panels are now easy to find in Kilwa District.

## SOCIO-ECONOMIC PRINCIPLES

### 11. TO SUPPORT AUTONOMY

The architecture reinforces community self-sufficiency. The fact that buildings are mainly made of local resources is a guarantee of resilience. Only few materials such as PVC pipes or electric fittings are imported from outside.

### 12. TO PROMOTE LOCAL ACTIVITIES

The architecture enhances local production, processing and trade.

### 13. TO OPTIMISE CONSTRUCTION EFFORTS

The architecture optimises the energy needed to build. Most of the energy required is human energy. Electricity or petrol are not necessary to erect traditional houses, and very few tools are used.

### 14. TO EXTEND THE BUILDING'S LIFETIME

The architecture increases resistance through time and long-term use.

### 15. TO SAVE RESOURCES

The architecture prevents local resources from waste and losses.





*Contemporary structure in Nangurukuru using local materials and techniques*

# From local to sustainable architecture

5

Architecture is one of the cultural expressions of a place. The way we construct our buildings is a part of the culture, like the way we speak and think, the way we prepare food, the way we wear clothes or the way we play music. All these features represent the culture of a place, and are always different and unique.

A few years ago, importing materials was much more difficult than nowadays, so people would build using locally available materials. Each building was responding exactly to the needs of its people. Builders developed techniques that would pass down to the next generation. Interesting innovations would survive, faulty ones would be abandoned, and so building culture was enriched in what we call an “evolutionary intelligence”. No buildings are more adapted to a place than those that have been improved over the centuries. The design of a new building should not start from scratch. Instead, it should take its local intelligent architecture, and pass it to a new creative production.

A cultural landscape is the result of centuries of innovation. Each village is a collective creation of its inhabitants. Each one of its buildings contributes to the whole display of the village. If contributions were totally imported, the result would be a mixture of buildings with no specific culture behind and every village would finally look the same. But if Kilwa buildings take the inspiration of the previous ones, some of their features will be improved and the cultural heritage will be preserved. It is the public role of the municipality with the help of its technicians to define collective standards and features that should be preserved in the urbanization process.



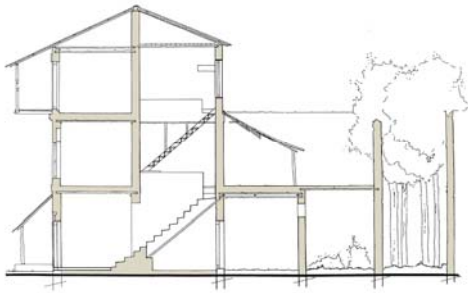




*Kilwa Information Centre under construction in 2015*

# From local to sustainable architecture

5



*Section drawing of a 19<sup>th</sup> Century House in Kilwa Kivinje, built with coral stones, lime mortar and wood. This example shows the efficiency of local materials and techniques to erect healthy buildings that can last for centuries.*

*Drawing by architect Valerie Goulet*

Very often people have the impression that local materials provide poor constructions because they are associated with people that cannot afford imported materials. But it is also possible to see very wealthy buildings, like eco-lodges and hotels constructed displaying local materials and techniques, by well-known artisans and very precious details. We can also observe hundreds of houses which are poorly constructed with imported materials. They wear out very fast and present many defects due to the incorrect way they were built. Importing a material without the required knowledge, apart from not benefiting the local economy, normally ends with bad results. New buildings with imported materials repeat the same construction errors because the process of construction itself is misunderstood.

Imported materials are often deceiving. They give the impression of strength and durability, but end up being disappointing in the long run. This is the case with reinforced concrete for example, which cannot last long in the saline environment, and which is impossible to repair. Their use should be limited to the minimum to avoid depleting the local economy, to limit pollution and escape the cultural corruption that other small cities have suffered.

Buildings in Kilwa were not previously designed and then built. The design of these buildings is intimately linked to the construction process. The same people who imagined the building, from its general layout to its details, are the same people who constructed it, so the logic of the design was determined by the resources available. There are no impossible details, fancy concepts or heavy ideas imposed.

Most of the buildings are produced without the expertise of an architect or technician. Even when design or survey fees for construction are afforded, every building requires maintenance during its entire lifespan. Construction based on local techniques allows the owner to participate in the process and so to understand the maintenance required. They can make the house last longer by themselves. And for those who do not have the skills themselves, local technicians would always be available.



# Earth<sub>MATOPE</sub>

## DESCRIPTION

Various types of soil can be found in Masoko, including clayey and sandy ones. The clayey soil is used for the construction of wattle and daub structures and adobes walls while the sandy one serves for plastering walls or making floors.

## SOURCES

Sandy soil quarries are found near Makubuli harbor, on the slopes of the hill.

## ADVANTAGES

- Resource widely available and cheap
- Easy to prepare and use
- No need for chemical stabiliser
- Regulates heat and humidity

## INCONVENIENTS

- Should be protected from humidity (rising damp and rains)
- Low tensile strength, fragile on swelling lands, which are common in some parts of Masoko

## USES

- Construction of walls with a wooden structure (wattle and daub / Nyumba za Udongo)
- Mortar for stone wall construction
- Wall plasters
- Production of mud bricks
- Mixed with lime, for lime wash



# Local materials and techniques

6

## Coral stones MATUMBAWE

### DESCRIPTION

These stones come from dead reef coral quarries mixed with the limestone on which they were attached. They have been used for the construction of the buildings of Kilwa Kisiwani and Songo Mnara for centuries, so the techniques employed are known and their resistance is already proven.

### SOURCES

At Songo Mnara Island. They are broken into big pieces and collected in boats before being sent to the main land.

### ADVANTAGES

- Very durable
- Beautiful
- The exploitation and use is well understood

### DISADVANTAGES

- Hard to cut
- Transport depends on tides
- Sometimes the salt in the stones have not been properly washed away

### USES

- Construction of walls with soil or sand-lime mortar
- As part of the mixture of wattle and daub filling
- Construction of building foundations
- Traditional production of lime

NOTE: It is very important to make the distinction between coral stone taken from quarries and coral harvested from the sea. Taking coral from the sea is profoundly unsustainable and threatens livelihoods.





# Aggregate KOKOTO

## DESCRIPTION

This aggregate comes from local coral stone and limestone disaggregated into small pieces, so their features are similar to the ones described on the previous page.

## SOURCES

Women collect and break the stones and then classify them into two different sizes: small (about 1-2cm) and big (about 3-4cm or more)

## ADVANTAGES

- Hard
- Not salty
- Quarried in small quantities, with respect of the environment

## DISADVANTAGES

- Not sure if big quantities would still be quarried the same way

## USES

- Preparation of concrete for slabs and beams
- Extended on the ground, as a layer to avoid muddy paths after rains



# Local materials and techniques

6

## Sand MCHANGA

### DESCRIPTION

Sand can be found in two colours in Masoko: white or light brown colour. The sand has fine round grains.

### USES

- Part of the composition of concrete for slabs and beams
- Stabilisation of clayey soil

NOTE: Sand should only be taken from authorised sand pits, and never from the beach. Removal of beach sand can lead to severe land erosion.

### SOURCES

White sand is normally extracted from a pit located a few kilometres to the North of Kiwa Masoko (Mpara/Masakasa). The coloured sand is taken directly in town.

### ADVANTAGES

- White sand is very pure

### DISADVANTAGES

- As white sand is more expensive, the brownish polluted one is often improperly used.
- Sometimes sand comes with some salt, which will appear later on the surface of the wall





# Lime CHOKAA

## DESCRIPTION

Local lime is sold in 40kg bags. It consists of quicklime already hydrated and powdered. Lime mortar should be prepared at least a day before it is used.

## SOURCES

The lime is produced on Songo Mnara island in traditional kilns, by burning coral stones and clayey soil with mangrove timber, at a minimal temperature of 900°C. It is an old practice (first kiln from 12<sup>th</sup> century discovered at Kilwa Kisiwani. It was 6m-diameter and 90cm deep).

## ADVANTAGES

- Hardens slowly, easy to use
- Adapted to salty environment
- Good weathering
- Sanitizes buildings

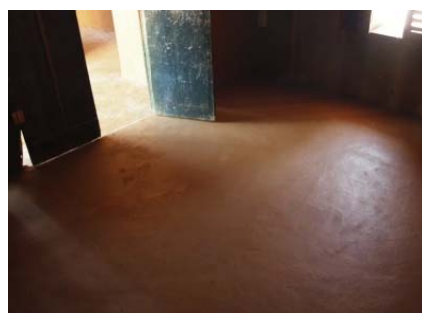
## DISADVANTAGES

- It requires significant quantities of mangrove wood to burn the limestone
- It is necessary to protect lime mortar walls against the rain while building
- Workers need to protect their skin to avoid its corrosive properties
- It is not possible to control the quality of lime production

## USES

- Used with sand for preparing mortar for laying stones
- Floor slabs and screeds
- Plastering of walls, door and window frames
- White pigment for lime wash (combined with water)

Limestone used for burning should not be taken from live sea coral but quarried unless it is a small-scale business, but when scaled up it would rapidly begin to damage the intertidal environment with bad consequences.



# Local materials and techniques

6

## Soft timber MBAO LAINI

### DESCRIPTION

This kind of timber is the cheapest and the one mostly used for temporary purposes. The Forestry office classifies it in two types:

- Class III for the softer ones (*mnepa, msufi pori*),
- Class II for the intermediate ones (*mtondolo, mkuruti, muhama*)

### SOURCES

It comes from the forest. It is cut, dried and presented in planks available at legal sawmills. It is sometimes illegally cut and intercepted by the police, who send it to the Forestry Office for its storage and then it starts a legalization process.

### ADVANTAGES

- Easy to cut
- Light
- Cheaper than other woods

### DISADVANTAGES

- Non-durable
- Easily eaten by termites

### USES

- Temporary structures such as small shops
- Formwork to cast concrete
- Scaffolding
- Temporary tools (rammers for example)





# Hard timber

MBAO NGUMU

## DESCRIPTION

This kind of timber is used for furniture and roof structures. It is usually presented in lengths of 8 feet (about 2,40m) and various width and thickness. Its price depends on the tree species. The Forestry office classifies it in two types:

- Class IA, only for blackwood (mpingo)
- Class IB for teak (mninga, mkongo, mvule, mpanga, mseke)

## SOURCES

It comes from the district forests. It is cut, dried and presented in planks available at legal sawmills. It is sometimes illegally cut and intercepted by the police, who sends it to the Forestry Office in Masoko for storage. It then undergoes a legalization process.

## ADVANTAGES

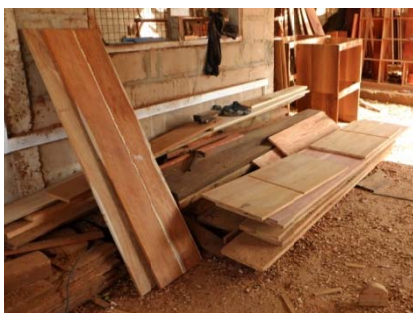
- Good durability
- Easily assembled
- Good resistance to termites when it is ventilated

## DISADVANTAGES

- Scarce resource, obtained from trees which grow very slowly
- Hard to work out with hand tools

## USES

- Roof structures (especially when covered with iron sheets)
- Windows and doors frames
- Windows and doors shutters
- Furniture and carving



# Local materials and techniques

6

## Mangrove poles NGUZO, BORITI, MKOKO MANGODI

### DESCRIPTION

Mangrove wood is very popular in Kilwa, probably because it is resistant to termites attack. Mangrove wood has a nice golden colour and can be found quite straight and in long dimensions.

### SOURCES

It is collected in the mangrove areas, classified and left to dry for several weeks.

### ADVANTAGES

- Hard wood
- Resistant to termites and borers

### DISADVANTAGES

- Overexploitation damages the mangrove environment, endangers wildlife, causes erosion of the coastal, increases the risk of damage from storms and threatens livelihoods.

### USES

- Structure of the wattle and daub houses
- Roof structures (especially with thatch covering)
- Ventilation grids





# Bamboo

MIANZI

## DESCRIPTION

Bamboo is easily available in the entire district. Two different species can be found, small ones and big ones.

Big bamboo measures 4/7 cm in diameter and 4,5/5 m in length. Small bamboo is Ø 2/3 cm and 4,5/5 meters in length.

## SOURCES

Bamboo can be purchased in Kilwa Masoko, already cut. They come from villages inland, such as Migeregere or Mbate.

## ADVANTAGES

- Resource widely available and cheap
- Not endangered, regenerates fast
- Light weight, easy to transport and handle
- High tensile strength
- Can be easily split lengthwise into two pieces or more

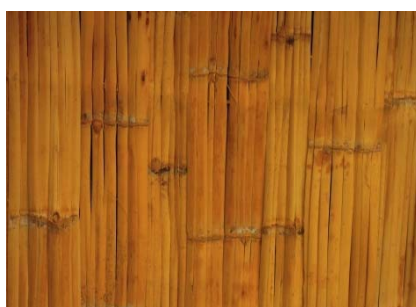
## DISADVANTAGES

- Breaks easily when nailed
- Needs some know-how, but easy to learn

## USES

Bamboo is used in many different ways, in full or cut lengthwise in halves or quarters. Common uses include:

- Fencing
- Partitioning of spaces
- Roof structures (battens)
- Mats



## Palm leaves thatch MAKUTI

### DESCRIPTION

This thatch is very common and well adapted to the weather. The “tiles” are about 80cm wide and 60cm high. The price depends on the overlapping used. The overlap should be at least one third of the height. The slope of the roof should be 45° minimum to avoid rain infiltrations and fast drying.

### SOURCES

The good quality ones are made of palm leaves attached together to a stick, which is then attached to the roof battens. There is another technique with stalks that are directly inserted in the battens. This technique looks more homogeneous (horizontal lines are not visible from outside)

### ADVANTAGES

- Keeps the building ventilated and fresh
- Lightweight roof and more resistant to windstorm than iron sheets
- Damaged pieces can be replaced
- Can adapt to any shape

### DISADVANTAGES

- Prone to fire
- Deteriorates if the roof is too shallow and retains dampness
- Can have insects and small vermin living inside

### USES

- Roof covering
- Temporary covering of walls





# Grass thatch NYASI (straw)

## DESCRIPTION

Grass thatch gives a hairy texture appearance.

## USES

- Roof covering

## SOURCES

This type of high grass is common in the entire district, even in Masoko, along the road between the airstrip and Masakasa.

## ADVANTAGES

- Keeps the building ventilated and fresh
- Lightweight roof and more resistant to windstorm than iron sheets
- Can adapt to any shape
- Very economical

## DISADVANTAGES

- Prone to fire
- Needs constant renovation



# Local materials and techniques

6

## Braided coconut palm sheets MADEMA

### DESCRIPTION

These sheets are made of coconut palm leaves that are braided. It is the cheapest material to block the view. Assembling coconut palm leaves is the easiest way to close a wall or a piece of land without making a permanent construction. It looks very nice and it is very fast to install.

### SOURCES

These sheets are made everywhere coconut trees grow, including in Masoko. It is a quite simple technique consisting in bending half a leaf by its centre and braiding on to the other side.

### ADVANTAGES

- Fast and cheap installation
- Material that “breathes”, perfect for good ventilated spaces
- Can be replaced by piece
- Resistant to winds
- Very accessible technique

### DISADVANTAGES

- Weathers not very nicely

### USES

- Garden and plot fences
- Temporary building walling
- Ridge cap for makuti roofs





# Mats MIKEKA

## DESCRIPTION

They can be presented in natural colour or dyed with different colours and figures. They can be ordered in any size, but usual size is around 2x2 m.

## USES

- They are traditionally used to wrap corpses for funerals
- They are also used as mats to lay on the floor for sitting, eating or praying
- In construction, they can be used as ceilings or as the under layer of a floor, in order to avoid dust falling onto the lower floor, or just for decoration
- Can easily be cut

## SOURCES

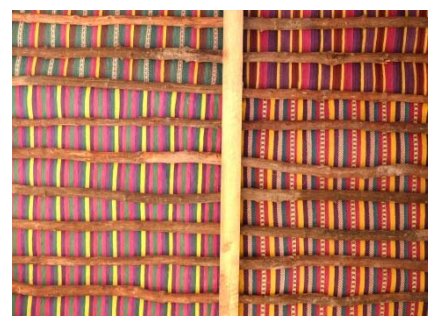
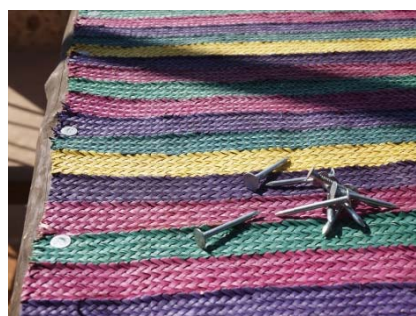
They are normally produced by women from shrub leaves dried, coloured, braided in stripes and sewed together. It is a long process that can take a woman one month to complete.

## ADVANTAGES

- They do not block humidity, so they avoid condensation
- They are always unique

## DISADVANTAGES

- Edges can get unbraided
- It takes time to produce them, so they should be ordered in advance



# Local materials and techniques 6

## Ropes KAMBA

### DESCRIPTION

The local ropes are very strong, flexible and resistant. They are usually employed to package goods and for transportation, but they are also employed in the construction for all kinds of knots.

### SOURCES

Old men and women slowly produce ropes at their houses, usually based on special orders. They dry the leaves of shrubs, put them together and braid them in long lines of more than 50m

### ADVANTAGES

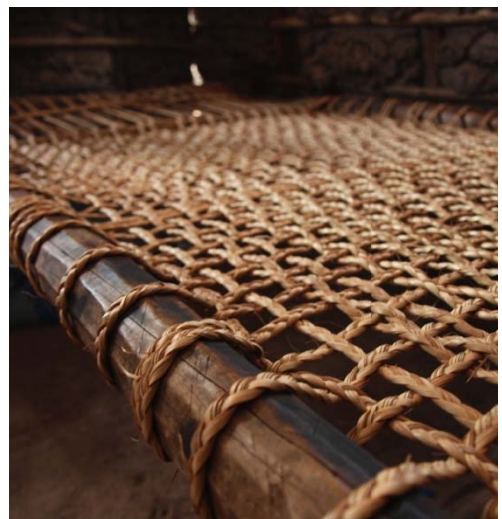
- They can be produced in any length
- They are very cheap
- They are resistant if they are kept dry

### DISADVANTAGES

- They can be attacked by mould
- They stretch if they are wet, what can produce loose leashes

### USES

- Transportation of all kind of goods
- Joining poles or tying pieces together
- Production of furniture such as beds or chairs







# Case study: Kilwa information centre

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## Design process

Prior to construction, the architectural programme and its spatial organization were discussed with the future building users, technicians and township authorities. After several group visits to analyse Kilwa architecture, the first plans were proposed by the architect<sup>1</sup> and revised by all partners. Several presentations of the project to the urban planning department were needed to obtain the construction permit. They were convinced by the idea to use local materials for a public building to set an example in Kilwa for other investors who might want to build contemporary structures. The township proposed the location at the market, which proved to be a wise option for an information centre: the site is visible from the road; it is easily accessible and stands at the hearth of the city, next to the station where visitors arrive to Kilwa by bus.

## Community response

The construction process quickly became an event in town. A banner in Kiswahili was hung on the walls to inform the population about the future role of the building. People were allowed to access the site. They kept visiting it on a daily basis, to discuss the evolution and design. They took a lot of pictures, which is a good sign of how proud they were of it. The materials of this building are familiar to them because they use the same for their private homes. They are only set differently. Several visitors said they want to build something similar.

## Construction process

The erection of the building, illustrated in the following pages took 9 weeks in total and mobilised 25 people.

<sup>1</sup> Architect Arnaud Misse, CRAterre



## CONSTRUCTION PLANNING

[illegible]

# Case study: Kilwa information centre

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*Stone and lime mortar structures  
on Kisiwani Island*

## Materials and techniques used

With the Dar-Kilwa road completed, imported materials are starting to invade the shops. This will impact the environment, affect the authenticity of the place and reduce local economic opportunities. We wanted to prove that contemporary architecture can make use of the techniques developed over the past 1000 years in Kilwa. New architecture does not require new materials. The only imported components in the building were the steel bars inserted in the lower ring beam as a crack-prevention measure and the electric fittings. Apart from this exception, all materials were locally sourced: coral stones, sand, soil, lime, wood, bamboos, palm leaves shingles and woven mats. Even the cement used in the foundation is produced in Kilwa. This means that most of the money spent on the building benefitted the population, either in the form of direct labour, or in the form of materials production. For instance, the four mats used to cover the office ceiling represent twelve months of work for a woman. The production of mats generates labour. Hand-made mats are unique and of course more appealing than the conventional plywood sheets.

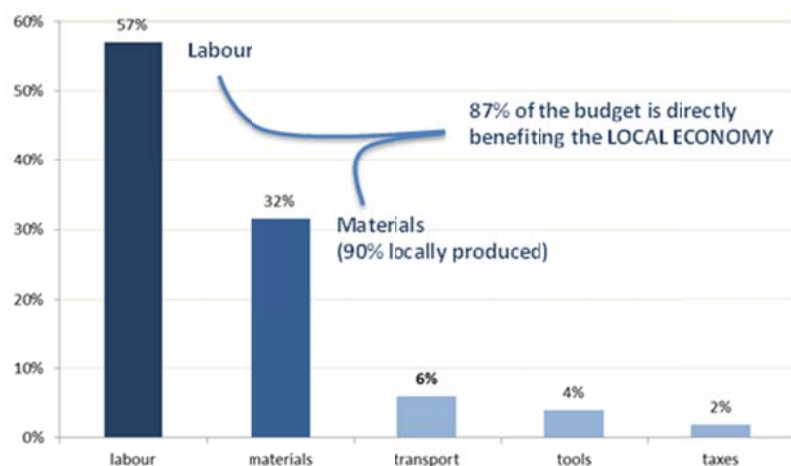
## Building cost

The final cost of the building is 26,178,334 shillings, which was equivalent to 13,528 euros. This is cheaper than the conventional cement block buildings with corrugated iron sheets roofs that are generally used for public structures.

The chart shows that out of the 26 million shillings spent on the building, nearly 15 million were spent on labour.

Transport is limited to 6% only.

Using local resources increases employment rates and reduces the carbon emissions thanks to limited transport.





## Illustrated construction process

### WEEK 1 : Site preparation



*Preparing the masons team – Tools and water tank – Marking and digging foundation trenches*



# Case study: Kilwa information centre

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## WEEK 2 : Foundation and slab



*Building foundation walls – Building ring beam formwork – Pouring ring beam – Filling and compacting soil*



## Illustrated construction process

### WEEK 2 : Foundation and slab



*Building formwork for pillars – Pouring slab and pillars – Installation of earth rod – Shaping draining soil slopes*



# Case study: Kilwa information centre

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## WEEK 3 : Walls and Frames



*Preparing lime mortar – Setting reference poles for verticality of works – Breaking and shaping stones*



## Illustrated construction process

### WEEK 3 : Walls and Frames



*Producing and installing first window frames – Lime finishing and protecting its slow hardening*



# Case study: Kilwa information centre

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WEEK 4 : Walls and Frames



*Scaffolding – Anchoring window frames – Producing and delivering door frames – Producing banner*



## Illustrated construction process

### WEEK 4 : Walls and Frames



*Stone walling – Setting position and anchoring doorframes – Preparing production of ring beam*



# Case study: Kilwa information centre

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WEEK 5 : Wall top, Ring beam, Beams and Benches



*Levelling cement layer on top of stonewalls – Building Swahili benches and plastering cement layer*



## Illustrated construction process

### WEEK 5 : Wall top, Ring beam, Beams and Benches



*Treating wood – Connecting timber ring beam pieces and transversal beams – Producing pillars*



# Case study: Kilwa information centre

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## WEEK 6 : Roof and Baraza structure



*Erecting reference poles – Setting principal trusses, ridge and battens – Dismantling reference poles*



## Illustrated construction process

### WEEK 6 : Roof and Baraza structure



*Completing battens – Shaping ridge sides – Reinforcing trusses – Tying palm leave shingles*



# Case study: Kilwa information centre

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WEEK 7 : Soil plastering, lime plastering, Office top slab and Kivinje door

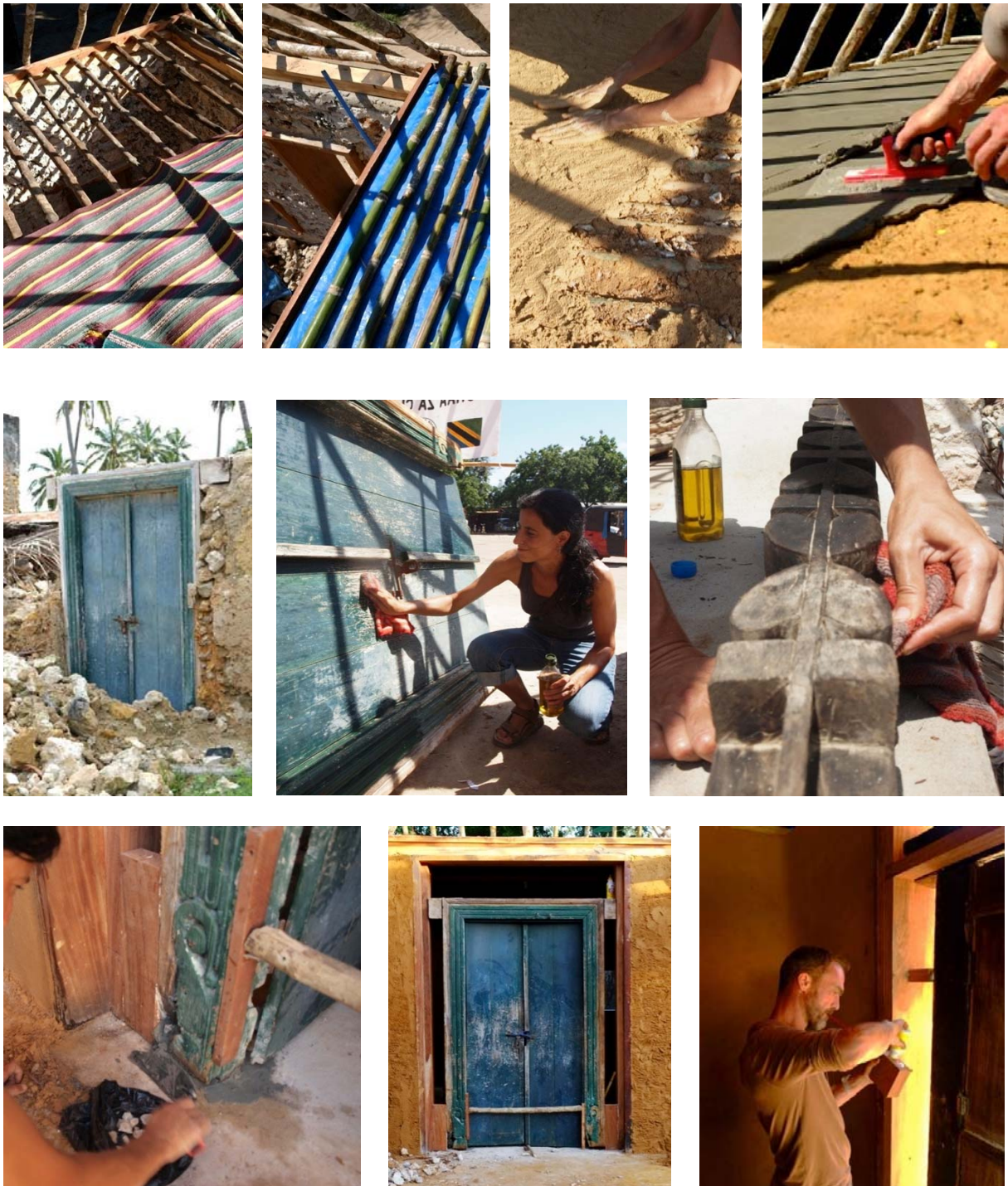


Testing soil & sand tests – Levelling and plastering walls – Lime plastering of benches and reception desk



## Illustrated construction process

### WEEK 7 : Soil plastering, lime plastering, Office top slab and Kivinje door



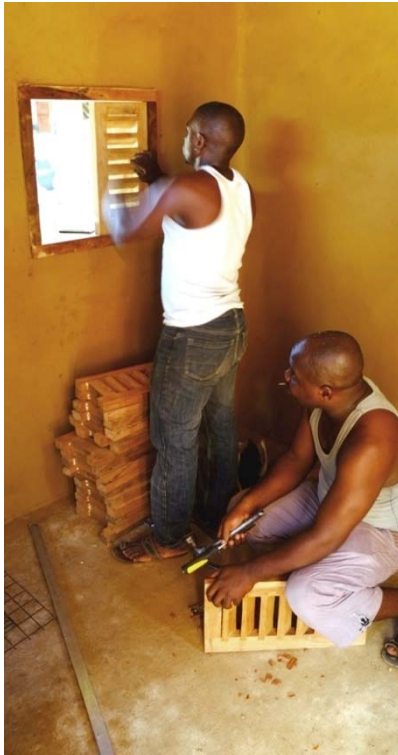
*Office flooring (mangrove, fibre mats, polythene, bamboo, soil & stones, plastering) – Installing old Kivinje door*



# Case study: Kilwa information centre

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WEEK 8 : Windows and doors shutters, Electricity and Furniture



*Installing windows shutters, handles, stoppers and security bars – Installing doors and top vent grids*



## Illustrated construction process

### WEEK 8 : Windows and doors shutters, Electricity and Furniture



*Installing electricity – Building reception desk, box benches, Info Centre sign, office screed and ladder*



# Case study: Kilwa information centre

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WEEK 9 : Finishes and Furniture



*Closing roof gables and door grids – Top walls plastering – Lime washing – Floor cement screed – Signs*



## Illustrated construction process

### Finished Building





# Case study: Kilwa information centre

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Finished Building





## General

- Seek advice and **permission from the Town planning office** before building anything.
- If you build in one of the **historical settlements** (Kisiwani, Songo Mnara, Kivinje) seek permission from the Antiquities office to make sure you respect the existing law.
- **Do not invade natural reserves** to respect wildlife. Do not encroach on natural areas such as beaches, mangroves or forests.

## Urban landscape and position of the building

- Try to **blend with the landscape** rather than compete with it. Try to match with the general town atmosphere by repeating existing features (**shapes, details, materials and colours**). Do not break the line of the street with conspicuous shapes or protruding elements.
- **Align** your building with others to respect the general layout. Orient the **front** elevation and the main door toward the street. **Do not build higher** than adjacent buildings. **Avoid storey buildings** to respect the low skyline of Masoko.
- Do not build on public paths and pedestrian walkways. **Avoid blocking access** to other houses, to the beach, to the market, to the main road or to any other important spots in town.
- If the plot has **trees**, try to keep them to take advantage of the trees and maintain the **biodiversity**. Plant trees along the street in front of the building to reinforce this **urban feature**. Plant trees that can **protect the buildings against the sun**.
- Make clever use of the climatic features. **Openings** should allow efficient **cross-ventilation**, especially in the East-West direction (sea winds). Provide **ventilation holes** in the upper part of the walls to facilitate ventilation between the roof and the ceiling. Windows should **not intrude into the neighbours' privacy**. If it is the case, block the view with a fence (made of plants or organic materials).
- Organise the front part of the building in such a way that it **brings life to the street**. Do not hide the building behind a highly secured fence. Rather create active outdoor spaces to encourage interaction between neighbours. Provide **meeting places outside** the building where people can rest in the shade (**Barazas and bandas**). Equip these spaces with **Swahili benches** or any other fitting that is of mutual benefit to surrounding inhabitants.



# Architectural recommendations

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## FOR KILWA MASOKO

### Materials and design

- Draw **inspiration from existing shapes** and features that have been used over the centuries. Your building should complement the **predominant architectural style** and pay homage to the vernacular architecture, even if it looks contemporary.
- Use **local materials that contribute to Kilwa economy rather** than imported resources that contribute to the loss of income for the town and more generally for Tanzania. Keep to local materials that are sourced within the shortest possible distance from Masoko (recommended a radius of about 20 km).
- Study existing **construction details in terms of durability**. Instead of starting from scratch, copy the most efficient solutions optimising and adapting them to the present needs.
- Use plants or **natural materials** to build fences. They match with the natural landscape of Kilwa and permit the **preservation of wildlife**.
- Make sure that the **wood** you are using has been **legally cut in a sustainable manner**, with the full consent of the community attached to the forest.
- Avoid materials that are prone to **deterioration by the saline environment** in the long term such as steel, iron sheets and reinforced concrete.
- Avoid **oil paint on plastered surfaces** and all kind of materials that block the exit of humidity.
- **Draw according to the available materials** and their full dimensions to avoid wasting resources. If you have access to old materials (stones, rubbles, timber) **reuse or recycle** them rather than purchasing new ones.
- **Limit the use of industrial materials** such as cement blocks or tiles **to the most fragile parts** of the building (foundations, wall basement, walls in direct contact with water...).

### Construction, use and maintenance

- Before starting construction, ensure that the owner can afford **the construction of entire elements**. Rather propose a design that can be **built in phases**, to make sure the building will not be abandoned before its completion due to lack of financial resources.
- Avoid exposing **workers and users** to toxic or dangerous materials. Use materials that do not threaten health such as soil, stones or wood rather than cement or oil paints for example.
- **An easy maintenance** is ensured by the use of natural available materials. Local craftsmen or even the users themselves should be able to maintain their houses at low cost.
- **Replace damaged elements** as soon as possible. Leaving them produces a fast deterioration of the building and obliges to more expensive reparation works.
- **Study the rainwater drainage** in order to avoid stagnant water along the walls that will deteriorate the building (deformations, collapses). Avoid plants or shrubs too close to the building that will concentrate humidity along the walls.
- A well-ventilated building with thick stone or earth walls will provide a good comfort inside the building, which will **reduce the need of air-conditioning**.
- Sufficient lighting and the installation of **solar panels** if the roof is well exposed to the sun will help minimise the consumption of electricity.
- Installing devices to **collect rainwater** from the roof will reduce the consumption of tap water.









Kilwa Masoko is located in the beautiful Swahili land, which occupies nearly 3,000 km of coast from Somalia to the south of Mozambique.

Like any other town it is composed of elements that contribute to its richness and others that don't. Some of these elements are inherited from the past. Their nature has evolved over time under the influence of natural and cultural phenomena, sometimes positively and sometimes negatively. Cultural heritage is what we conserve, celebrate and cherish. It becomes incontrovertible attractions to tourists and scholars. But the same human beings who created them sometimes contribute to their destruction. Our heritage depletion can be attributed to what is known as new development. In Swahili we say "kupitwa na wakati, ni ya Kishamba", which means that old buildings are sometimes lagged behind in time because they are seen as uncouth things. When we build new houses using imported materials we tend to think that we are more civilized than ever, smarter than the past generation. We tend to say in Swahili "tumeendelea sana". For too many of us development means divorcing the ancient materials and culture to embrace the new ones.

This book invites us to embrace our heritage with a new thinking, with zeal and enthusiasm, to acknowledge the fascinating architectural creations of our ancestors. It shortens the distance to their achievements, and connects the past to the future.

Better considering the past will save us time and money, and will contribute to the local economic growth in a sustainable way. It will also maintain the true Kilwa spirit of peace and serenity, which brings relief to all people irritated by noisy and comfortless towns. This spirit is linked to unique natural and architectural spaces that are described in the book. They contribute to bring people closer and make them relax.

To produce sustainable architecture in Kilwa, new builders should not consider Kilwa's heritage as monuments of the past, that fall under academic conservation principles. They should study both the local architecture and the great monuments on the islands to understand all the values they contain. Contemporary buildings should pay homage to the previous fundis generations. By doing so, communities will be drivers of their own development and use their heritage as an inspiring resource.

The book ends with a series of recommendations for safeguarding the heritage and building in a sustainable manner.



**Revocatus Bugumba**

Head of Station, Kilwa antiquities office

